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SECTION III.—FORECASTS.

FORECASTS AND WARNINGS FOR JUNE, 1917.

By EDWARD H. BOWIE, Supervising Forecaster.

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Of the LOWS that appeared over the United States during the month of June, 8 made their first appearance over the western Canadian Provinces and belong to the Alberta type: 6 first appeared over the far Southwest and are classed as belonging to the Colorado type; and 2 secondary centers of low pressure made their appearance over the Great Central Valleys and are classed as the Central type. It will be noted on examination of Chart III, Tracks of Centers of Low Areas, that many of the storms of this month moved in high latitudes, and especially is this true with regard to the Alberta Lows, while the Colorado type of LOWS, 6 in number, moved in nearly all instances in a due northeast course toward the Great Lakes and thence passed down the St. Lawrence Valley. The only exception noted and the only LOW not classified is one that formed off the New England coast during the 17th and moved directly northward, crossing the St. Lawrence River and passing into Canada during the 19th. HIGHS were 9 in number, and of these 2 were of the Alberta, 5 of the North Pacific and 2 of the northern Rocky Mountain region type. The most important HIGH of the month is that one which appeared off the North Pacific coast on the 11th and moved slowly east-southeast, and its center passed off the South Atlantic coast on the 18th: this HIGH was attended by unusually high barometer readings for the season, the pressure at its center exceeding 30.60 inches on the 12th to 14th over Wyoming, while unseasonably low temperatures preceded and accompanied it during its march across the United States.

As shown by the daily cabled reports from Honolulu and the Midway Islands the HIGH that normally is centered west of and a considerable distance off the north California coast was of great geographical extent with pressures above the normal, while over the Alaskan area the pressure was also generally above the normal, the important exception being the first decade of the month when nearly all Alaskan stations reported a deficit in pressure. Over the western portion of the North Atlantic Ocean, as shown by the daily reports from the Bermudas, Grand Turks, and the Canadian Maritime Provinces, the pressure was high almost continuously during the month, and especially was this true in the vicinity of the Bermudas, where the excess was pronounced.

WASHINGTON DISTRICT.

Few storm warnings were required during the month, as nearly all the western disturbances were of only moderate intensity while passing over this district. The exceptions were the disturbance that was central the morning of the 2d over southeastern Iowa and which required warnings on the Great Lakes, except western Lake Superior and Ontario, and the storm that was central over northeastern Missouri the evening of the 5th, when storm warnings were displayed on all the Upper Lakes and western Lake Erie. In both instances the warnings were fully verified, particularly with regard to the latter storm, which was not only

attended by winds of gale force but also by destructive local storms in the region of the Great Lakes, the Ohio and middle Mississippi Valleys, western Missouri and Kansas. On the 13th southwest storm warnings were ordered for Lake Superior and northern Lakes Michigan and Huron, and the wind conditions occurred as forecast. No storm warnings were issued or required for the east Gulf coast, and the only warnings displayed on the Atlantic coast were in connection with the disturbance that developed off the New England coast on the 17th, warnings being displayed the evening of that day on the coast of Maine.

Warnings of local frosts were issued on a number of days for the northern border States, but no serious damage resulted from the frosts that occurred.

WARNINGS FROM OTHER DISTRICTS.

Chicago district.—While the temperature throughout this forecast district was unseasonably cool most of the month, no frosts actually occurred except in the more elevated regions and in the cranberry marshes of Wisconsin. In the former there is little vegetation susceptible to injury, but in the cranberry marshes there is almost always considerable danger. Special warnings were issued during the month as follows:

Frost warnings were issued for northwestern and central Wyoming on June 5th, 11th, 12th, and 13th; also for southeastern Wyoming on the last date. On June 11th and 12th warnings were issued for the exposed places in Montana, and on the 18th and 30th for extreme northwestern Wyoming. These warnings were generally verified in Wyoming and western Montana, but the frost did not reach to the eastern portion of the latter State.

Advices were sent to the Wisconsin cranberry growers on several dates, but because of the uncertainty regarding the possibility of cloudiness during the ensuing nights the forecasts were in several instances modified to cover the situation.

June 1: Frost warning was sent to Beaver Brook, in the northwestern portion of the State, and frost occurred on the following morning, with a minimum temperature of 28°. The other three stations—Berlin, Cranmoor, and Mather—were advised that the weather would probably remain cloudy but that frost would occur if the weather cleared; however, as cloudiness continued, no frost occurred.

June 3 and 13: Advisory messages were sent to all four stations that the conditions as regards cloudiness and probable frost were doubtful. As it remained cloudy, no frost occurred at any station.

June 14: Frost warnings were sent to the four stations, and heavy frost occurred at Beaver Brook, with a minimum temperature of 26°; but no frost was reported from the other stations, although Cranmoor reported a minimum of 32°.

June 15: Following the warning of frost on the 15th a minimum of 26° was reported at Cranmoor, with a heavy frost, but no frost was reported from the other stations.

June 21: Warnings were issued and minimum temperatures of 32° and 30° were reported from Beaver Brook and Cranmoor, respectively, but no frost was reported at any station.

It may be noted from the above that there was a wide variation in the temperature conditions in the cranberry marsh region within a small area, and this was entirely due to variation in the amount of cloudiness.

The Wisconsin cranberry growers are insistent that warnings be sent them whenever frost is possible, so that they may exercise proper caution, and in order that no frost may possibly occur without being forecast advisory messages are occasionally considered advisable when there seems only slight prospect of occurrence of frost. This is because the cranberry is in bloom during the latter part of June, and is especially susceptible to damage then and for some time previous. Even light frost may prove serious, provided the bogs are not flooded in advance.

Because of the protracted dry weather in May and early in June the Minnesota forests became susceptible to great damage from forest fires, and, following the outbreak of extensive fires, special wind and temperature forecasts were issued to the National and State forests on June 9, 10, 13, 14, 16, 17, and 18, as fresh winds were anticipated. No further advices were deemed necessary during the balance of the month, because of rains in the forest regions eliminating further danger.

In connection with the harvesting of alfalfa it is customary to extend the weather forecast for the alfalfa-growing States in this forecast district to the third day, when fair weather seems probable. Such advices were sent on June 13, 14, and 18 to the States of Iowa, North and South Dakota, Nebraska, Kansas, Montana, and Wyoming; June 23, to Wyoming; June 25, to Minnesota, North and South Dakota, Nebraska, Montana, and Wyoming; June 30, to Nebraska, North and South Dakota, Montana, and Wyoming. All these forecasts were practically fully verified.

In response to a request a special forecast for generally fair weather was made for Rapid City, S. Dak., for the period from June 11 to 16 during the South Dakota Firemen's Tournament, and during the entire period only one light shower occurred. Regarding the advice the observer at Rapid City reports that it was highly satisfactory.—*H. J. Cox, Forecaster.*

New Orleans district.—No general storms occurred on the Gulf coast during June and no storm warnings were issued.

Warnings for alfalfa interests were issued June 6 and repeated on the 7th for Oklahoma and Texas for fair weather up to and including the 9th and for Arkansas up to and including the 8th. Some precipitation occurred in Arkansas and eastern Oklahoma during the night of the 7th, otherwise the weather was fair during the period covered by the forecast.

Warnings for alfalfa interests were issued June 13 for the entire district except Louisiana for fair weather up to and including the 16th and were repeated on the 14th for the entire district. No precipitation occurred during the period covered by the forecast. Warnings were also issued on the 27th for Oklahoma and Texas for fair weather up to and including the 29th. No precipitation occurred in the area specified during the period covered by the forecast.—*I. M. Cline, District Forecaster.*

Denver district.—June was dry, and moderately high pressure prevailed. Such cyclonic areas as affected the district were either in the early stages of development or were of the Alberta type, causing dry southerly winds. The unseasonably cold spring weather of April and May continued during the first seven days of June, but the remainder of the month was generally mild. Warnings of local frost for portions of Colorado and Utah were

issued on June 1, 4, 5, 11, 12, and 13, and were generally fully verified. On the morning of the 13th a temperature of 30° was reached at Modena, Utah—the lowest of record at that station for June.

On the evening of the 9th the southward extension of an Alberta low was attended by rapidly falling pressure in Utah and northern Arizona, and fire-weather warnings were issued for New Mexico, Arizona, and Utah. High winds occurred on the 10th in Utah and Arizona, reaching 40 miles per hour or more at some stations. On the evening of the 10th the warnings were extended to include northern Colorado, and a velocity of 40 miles occurred in extreme north-central Colorado.

With the exception of high temperatures in portions of Arizona in the latter part of the second decade, the remainder of the month was free from unusual weather conditions. The temperature reached 118° at Yuma on the 15th and 16th, being the highest temperature ever recorded at that station in the month of June.—*Frederick W. Brist, Assistant Forecaster.*

Portland, Oreg., district.—June was nearly a normal month in this forecast district; there were no general rains, although those falling on the 9th and 10th were nearly so. The dominant factor in controlling the month's weather conditions was a high pressure area which was present most of the time off the North Pacific coast.

Frost warnings were issued on the 2d, 4th, and 11th for the eastern portion of the district, and local frost warnings were sent out on the 3d, 9th, and 10th. On the 2d the warning was not verified because general cloudiness prevented the expected rapid radiation; the warnings of the 3d and 10th were fully verified, and the remaining forecasts were partly verified. Frosts occurred on the 2d and 4th in limited areas (two stations reporting on each date), but little damage occurred.

No live-stock warning was issued, but one fire-weather and one storm warning were issued. On the 18th with the prospects of a week of fair warm weather the following warning was sent out:

Large HIGH over Northwest spreading eastward, lows over Arizona and upper Mississippi and Red River Valleys. Light, variable winds to-day, Tuesday, Wednesday; probably mostly easterly Thursday, Friday, Saturday. Continued fair, warm, dry weather. Increasing fire hazard below snow line.

The expected change in wind direction did not occur until Saturday; otherwise it was a good forecast.

On the evening of the 23d a vigorous HIGH reached the northern California coast while a moderate depression was over the mouth of the Columbia River; southeast storm warnings were ordered for that section and Grays Harbor. The warnings were justified, but they should have been extended to Tacoma, where a maximum velocity of 32 miles from the southwest occurred on the afternoon of the 24th. No resulting damage has been reported.

On the morning of the 28th the pressure distribution over the Northwest was expected to result in showers and thunderstorms over the eastern portion of this district, but the low moved rapidly northeastward to Alberta and the forecast was not verified at any reporting station.

On account of the greater amount of snow on the ground remaining late into the season, the fire hazard at present is not great, although some small fires have occurred in slashings. The forestry and conservation officials have been keeping in close touch with us, and efforts will be made to afford greater protection from fire than in any previous year.—*T. Francis Drake, Assistant Forecaster.*

San Francisco district.—No storms passed over this district during June, the only rain reported being a shower at Reno, Nev., on the 6th, and a thunderstorm at Winnemucca, Nev., on the 10th. They both occurred without warnings.

The first decade was cool in California, and the first half of the month cool in Nevada. Frosts occurred in northern Nevada on the 11th and 12th, without warnings.

The temperature began to rise in California on the 11th, and continued until the 19th. The rise was in most places gradual and the forecast of continued warm weather after the 12th seemed to cover the situation quite well. On the 15th the extreme maximum tem-

perature, 110° F., occurred at San Luis Obispo; and on the 17th, the record maximum temperature, 106°, occurred at Los Angeles. The intense heat was confined to southern California and the coast in the vicinity of Point Conception.

Fire-weather warnings were issued to the Forest Service on the 18th, and again on the 30th. Damaging fires occurred in San Luis Obispo and Ventura Counties from the 15th to the 19th. While the fires were of incendiary origin, the intense heat, accompanied by strong dry northerly winds, greatly increased their energy.—*G. H. Wilson, District Forecaster.*